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STEPPE BY STEPPE: EXPLORING ENVIRONMENTAL CHANGE IN SOUTHERN UKRAINE

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This article considers the environmental legacy of Soviet central planning that began in the late-1920s and also longer-term human intervention in the 'natural' world of rural Southern Ukraine. Using the device of a travelogue of a journey across the region in May 2011, the author draws on his experience of the places he explored, in some cases with scientists who study and manage them, and research in a selection of written sources to reflect on issues of environmental change in a region that was once a vast expanse of steppe grassland.

Prior to the trip I had a notion that Southern Ukraine contained examples of three landscapes in which 'nature' had been, step by step, transformed, protected and destroyed by human action. Much of the region, formerly grassland used primarily as pasture, had been utterly transformed by ploughing to create arable fields producing crops. This transformation was intensified as a result of Soviet agricultural policies from the 1920s, but began after the annexation of the region to the Russian Empire in the late-eighteenth century. Southern Ukraine is also the location of the famous nature reserve at Askania Nova – 'the oasis of the southern Ukrainian steppes' – where a portion of steppe grassland has been protected from ploughing since the end of the nineteenth century. A contrasting image, of destruction, is presented by the Oleshkivs'ki pisky (sands) on the left bank of the estuary of the River Dnipro[1] opposite the city of Kherson. A striking landscape of dunes has been created by sands that have spread over the area. The sands spread after settlers who moved in after Russian annexation removed the existing woodland and grazed their herds of sheep. I set out to test the idea that transformation, protection and destruction best characterised human intervention in these three locations on the steppe. (See Map.)

NATURE TRANSFORMED?: THE SOUTHERN UKRAINIAN STEPPE

[1] Preference has usually been given to contemporary Ukrainian rather than Russian proper nouns, hence Dnipro rather than Dnepr for the river etc.

The journey started by bus in Odesa, the largest city in the region with a population of around a million. For some time we made our way through the northern suburbs, past rows of ubiquitous, Soviet-era, apartment blocks, which stood testament to the rebuilding of the city after the Second World War. At the end of the War, during which the city was under enemy occupation, the devastated remains sheltered around 200,000 people. This was less than a third of its pre-war inhabitants. Once a vibrant, multi-ethnic city, most of its large Jewish population had perished in the Holocaust.[2] The depopulation of Odesa during the Second World War interrupted a longer-term trend of urbanisation. Between 1939 and 1959, the number of rural inhabitants of Southern Ukraine fell from 3.0 to 2.6 million, largely as a result of out-migration, as the rural population declined from 63 per cent to 51 per cent of the region's total number of inhabitants.[3] The shabby Soviet-era buildings constructed to house the new urban population contrasted with the more refined architecture in the centre, much of which dated back to its heyday as one of the Russian Empire's great cities in the nineteenth and early-twentieth centuries. Odesa was founded in 1794 by Catherine the Great on the Black Sea coast of her new southern territories, which she had recently conquered from the Ottoman Empire. It rapidly became the Empire's main commercial port on the Black Sea, exporting agricultural produce from the steppe.[4]

Beyond the city, I observed the subtle contours of the steppe, the gulleys that cut through it, few trees, big blue skies overhead and crops growing in vast, unfenced fields. My travel notes read: 'patchwork of green, brown and yellow fields under blue sky'. Green – the shoots of the winter wheat, the main crop of the region, making good progress in mid-May; brown – fields still bare, possibly left fallow, or sown with the spring crops, most likely sunflowers, just starting to come up; yellow – a newer visitor to the steppe – oil seed rape.[5] The yellow rape fields and blue skies caricatured the Ukrainian flag: horizontal bands of a subtler yellow and blue that represent fields of

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[2] Charles King, *Odessa: Genius and Death in a City of Dreams* (New York: W. W. Norton & Company, 2011), p. 252.

[3] Karl-Eugen Wadekin, 'Internal Migration and the Flight from the Land in the USSR, 1939–1959', *Soviet Studies* **18**/2 (1966): 144–5.

[4] Patricia Herlihy, *Odessa: A History 1794–1914* (Cambridge, MA: Harvard Ukrainian Research Institute, 1986).

[5] 'The rise and fall of oilseed rape', *Agronomy-Ukraine*, Friday, 27 April 2012, http://agronomyukraine.blogspot.co.uk/2012/04/rise-and-fall-of-oilseed-rape.html (accessed 13 Jan. 2016).

wheat under the southern skies. Ukraine is one of the world's leading producers and exporters of grain, especially wheat.[6] In newly-independent Ukraine, the government privatised the state and collective farms, which are now run by a combination of large corporate agrobusinesses and smallholders.[7] Most of the land in Southern Ukraine is under cultivation. In many years, 85 to ninety per cent of the soils in the region are ploughed up. Unlike other parts of the former Soviet Union, fertile southern Ukraine did not experience large-scale land abandonment after the collapse of Communist Party rule and the end of the centrally-planned economy in 1991.[8] In contrast, in the neighbouring Russian Federation, in the decade after 1991, nearly twenty million hectares of arable land (around fifteen per cent of the total) were abandoned.[9]

The southern Ukrainian steppe is characterised by immensely productive black and chestnut soils (*chernozemnye* and *kashtanovye pochvy*), yet soil scientists have calculated that over the century between 1881 and 1981, they lost between 32 per cent and forty per cent of the organic matter so important for their fertility. Over the same period, the degraded soils also became more liable to erosion. These facts were results of inappropriate soil management under the collective and state farming established in the late-1920s. Collective and state farm directors prioritised short-term increases in crop yields and brought unsuitable land into cultivation to meet their output targets under the Soviet Five-Year Plans. Ukrainian scientists have conducted research into more sustainable methods using rotations of crops, which have yielded positive results. Nevertheless, the independent Ukrainian government has not, it has been argued, provided sufficient support to enable private farms to change from short-term yield

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[6] Chris Lyddon, 'Focus on Ukraine', *The Grain and Grain Processing Information Site*, 14 Nov. 2014, http://www.world-grain.com/Departments/Country%20Focus/Country%20Focus%20Home/Focus%20on%20Ukraine%202.aspx?cck=1 (accessed 13 Jan. 2016).

[7] Brian Kuns, 'Beyond coping: Smallholder intensification in southern Ukraine', *Sociologia Ruralis* (2016), doi: 10.1111/soru.12123; Jessica Allina-Pisano, 'Sub Rosa Resistance and the Politics of Economic Reform: Land Redistribution in Post-Soviet Ukraine', *World Politics* **56**/4 (2004): 554–581.

[8] S. V. Medinets et al., 'Changes in soil carbon and nitrogen dynamics during a three year crop rotation on a chernozem soil in the southern Ukraine', *Visnyk Odes'koho natsional'noho universytetu, Ser.: Heohrafichni ta heolohichni nauky* **14**/2 (2014): 144; Camilo Alcantara et al., 'Mapping the extent of abandoned farmland in Central and Eastern Europe using MODIS time series satellite data', *Environmental Research Letters* **8** (2013): 6.

[9] Grigory Ioffe, Tatyana Nefedova and Ilya Zaslavsky, *The End of Peasantry? The Disintegration of Rural Russia* (Pittsburgh, PA: University of Pittsburgh Press, 2006), pp. 137–8. The environmental conditions for farming are more favourable in Ukraine than the Russian Federation. ibid., p. 70.

maximisation. Rather, a monoculture of cash crops has prevailed, with negative implications for longer-term economic sustainability and environmental conservation.[10]

Not all the land I saw was arable. Some fields were surrounded by belts of trees, deciduous, not tall, a few metres deep, which had been planted to shelter the fields from the drying influence of the winds, threatening dust storms, drought and crop failure. Trees were most abundant in the villages where they have been planted to shelter the low, brick houses.[11] I also saw some cattle, presumably belonging to smallholders, grazing in gulleys, i.e. land not suitable for cultivation, and drinking from ponds dug near the settlements. Long gone, and gone forever, was the grassland of the steppe, with its rich flora and fauna, of past centuries.

The steppe of Southern Ukraine is part of the Eurasian steppe, which lies on the highroad from Asia to Europe, and has been fought over for millennia. The area I was travelling through had been the domain of Scythian nomads when Herodotus visited in the mid-fifth century BCE. He described the land as 'a rich and well-watered plain, with excellent pasture' and 'luxuriant' grass.[12] It remained the realm of a succession of nomadic peoples, who lived from their herds of ungulates grazing on the steppe grasses, culminating in the conquest by the Mongols in the mid-thirteenth century. When the Mongol Empire broke up, much of present-day Southern Ukraine came under the rule of the Tatar Khanate of Crimea (which included the steppe to the north of the Crimean peninsula as well as the peninsula itself). The Crimean Khanate was subordinate to the Ottoman Empire from 1475, and continued to be a subject of the Sultan for the next three centuries. Only in 1783 did Catherine the Great annex the Crimean Khanate to the Russian Empire. Encouraged by her favourite, Grigorii Potemkin, Catherine envisaged her new Crimean lands as a source of glory and as a garden of paradise. She christened

[10] S. V. Medinets et al., 'Changes in soil carbon and nitrogen dynamics during a three year crop rotation on a chernozem soil in the southern Ukraine', *Visnyk Odes'koho natsional'noho universytetu, Ser.: Heohrafichni ta heolohichni nauky* **14**/2 (2014): 143–65; Bo Libert, *The Environmental Heritage of Soviet Agriculture* (Wallingford: CAB International, 1995), pp. 189–90.

[11] There was large-scale tree planting in shelterbelts on the steppe in the postwar period. See Stephen Brain, 'The Great Stalin Plan for the Transformation of Nature', *Environmental History* **15** (2010): 670–700.

[12] Herodotus, *The Histories*, trans. Aubrey de Selincourt, further revised edn (London: Penguin, 2003), pp. 246–8, 255–8.

the whole of what became Southern Ukraine as 'New Russia' (Novorossiia).[13] In the early 1780s, Vasilii Zuev, a naturalist from the Imperial Academy of Sciences in St Petersburg, travelled across the region as far as the new port city of Kherson on the estuary of the River Dnipro. On his way, he noted 'open, dry and level steppe', with grassy meadows along the rivers and in valleys, but little forest. Large areas of steppe were not ploughed up, but grazed by horses and cattle. Elsewhere, however, he described the steppe as 'empty'.[14]

Catherine had ambitions for her new, southern lands, which prompted the start of the great transformation of the steppe from pasture to grain fields. By the turn of the twentieth century, the region had become the breadbasket of much of the Russian Empire and southern Europe.[15] Thanks to grain grown on the steppe, on the eve of the First World War, the Russian Empire was the world's largest exporter of wheat.[16] Over the previous century, the indigenous nomadic peoples had been displaced by settlers from other parts of the Empire and southeastern and central Europe, including Germans and Mennonites, whose ploughs pulled by teams of oxen had broken the sod, transforming the steppe ecosystem. Near monoculture of grain in areas with good transport links to ports, such as Odesa, had replaced the wild grasses.[17] The aftermath of the First World War and 'Russian Revolution' of 1917 brought turmoil to the region as it was fought over by Reds, Whites, Greens, Ukrainian nationalists, bandits, the Central Powers and Western Allies, before the Reds emerged victorious and consolidated Soviet power.[18] Stalin's forced collectivisation of agriculture at the end of

[13] King, *The Black Sea*, pp. 67–168; Andreas Schönle, 'Garden of the Empire: Catherine's Appropriation of the Crimea', *Slavic Review* **60** (2001): 1–23.

[14] Vasilii Zuev, *Puteshestvennye zapiski Vasiliia Zueva ot S. Peterburga do Khersona, v 1781 i 1782 godu* (St Petersburg: Imperatorskaia Akademiia Nauk, 1787), pp. 226, 250, 261.

[15] E. I. Druzhinina, *Severnoe Prichernomor'e v 1775-1800 gg.* (Moscow: Nauka, 1959); Leonard Friesen, *Rural Revolutions in Southern Ukraine: Peasants, Nobles, and Colonists, 1774–1905* (Cambridge, MA: Harvard Series in Ukrainian Studies, 2009).

[16] Barry K. Goodwin and Thomas J. Grennes, 'Tsarist Russia and the World Wheat Market', *Explorations in Economic History* **35** (1998): 405–430.

[17] David Moon, *The Plough that Broke the Steppes: Agriculture and Environment on Russia's Grasslands, 1700–1914* (Oxford: Oxford University Press, 2013).

[18] For an overview, see Orest Subtelny, *Ukraine: A History* (Toronto: University of Toronto Press, 1988). pp. 339–379.

the 1920s was implemented most vigorously in fertile, grain-growing regions such as Southern Ukraine, provoking mass, if ultimately largely futile, resistance.[19]

A little over a decade after the Soviet regime waged war on its peasants, Southern Ukraine was plunged into further turmoil when the German army and its Romanian allies invaded in 1941 and occupied the region before being pushed back by the Red Army in 1943–4.[20]

On my more peaceful travels through the steppe we at last reached Kherson. The view from my hotel room window that evening was filled by a large grain elevator, storing grain for export through the Black Sea, by the side of the river Dnipro. The next day my journey took me first from Kherson to Nova Kakhovka. The road is intermittently dead straight across the level plain and winding and hilly as it meanders through ravines and gullies. We passed a sign of the region's tragic history: a memorial to the victims of the *Holodomor*, the Ukrainian word for the terrible famine of 1932–3 when millions died as a result of the Soviet authorities' drive to collectivise agriculture, requisition grain from countryside experiencing a shortfall in production, promote rapid industrialisation and stamp out dissent at whatever the cost.[21] Famine returned to Southern Ukraine, and other parts of the Soviet Union, in 1946–7 as a result of the devastation wrought by the Second World War, drought and the inability of the government to take steps to avert the disaster.[22]

The Soviet government was well aware of the damaging consequences of recurring droughts in the steppe region. In 1950, it embarked on the 'Great Construction Projects of Communism', which included damming major rivers that flowed through the steppes to provide water for irrigation and use the water's power to generate electricity. Forced

[19] Robert William Davies, *The Socialist Offensive: The Collectivization of Soviet Agriculture, 1929–1930* (Basingstoke and London: MacMillan, 1980); Lynne Viola, V. P. Danilov, N. A. Ivnitskii and Denis Kozlov (eds), *The War Against the Peasantry, 1927–1930. The Tragedy of the Soviet Countryside* (New Haven and London: Yale University Press, 2005), p. 320.

[20] Evan Mawdsley, *Thunder in the East: The Nazi-Soviet War 1941–1945* (London: Hodder Arnold, 2007).

[21] On the controversial history of the famine, see Frank Sysyn and Andrij Makuch (eds), Special thematic issue devoted to the Ukrainian Famine of 1932–33, the Holodomor, *East/West: Journal of Ukrainian Studies* **2**/1 (2015).

[22] Nicholas Ganson, *The Soviet Famine of 1946–47 in Global and Historical Perspective* (New York: Palgrave Macmillan, 2009).

labour from the Gulag was used on the construction projects.[23] On my journey, I encountered dramatic evidence of the impact of Soviet power and the transformation of nature: the Kakhovka dam. Completed in 1956, it holds back the waters of the Dnipro to create an enormous reservoir 230 kilometres long and up to 23 kilometres wide. Water from the reservoir is channelled south to 'make fertile huge expanses of arid land'. The electricity generated was used to stimulate industrial development in the region.[24]

The Kakhovka dam is the subject of ongoing research by Ukrainian environmental historian Anna Olenenko. She has pointed to the consequences beyond the benefits envisaged by the Soviet planners. Over 250,000 hectares of land were lost to the reservoir, including fertile arable land and flood plains that had played an important role in the local economy. The dam fundamentally altered the hydrology of the region, slowing the pace of the river, with adverse consequences for the soil, flora and fauna, leading to an overall loss in biodiversity. The people whose settlements were flooded were rehoused, but many regretted the loss of their former homes, ways of life and traditions.[25] The human consequences were portrayed in a 1958 film, written by Oleksandr Dovzhenko and directed by his widow Iuliia Solntseva, entitled 'Poema o more' (usually translated as 'The Poem of the Sea'). At one point in the film, the chairman of a collective farm tells the assembled population that their village, with its long history, is living its last days. Their homes, orchards, school, club, and ancestors' graves will soon be at the bottom of the reservoir. Towards the end of the film – before a more heroic finale – the people watch from the high bank as their village and its trees disappear beneath the rising waters.[26]

Construction of the irrigation canals continued until the 1970s, when the Kakhovka irrigation system was the largest in Europe.[27] The area of irrigated land in Kherson

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[23] See Klaus Gestwa, *Die Stalinschen Großbauten des Kommunismus. Sowjetische Technik und Umweltgeschichte, 1948–1967* (München: Oldenbourg Verlag 2010).

[24] T.K. Petrov, 'Velikie stroiki kommunizma', *Les i step'* **11** (1950): 14; A.A. Grigoryev, 'Soviet Plans for Irrigation and Power: A Geographical Assessment', *The Geographical Journal* **118** (1952): 168–179.

[25] Anna Olenenko, 'Zatoplennaia pamiat' Pridneprov'ia: ukrainskie vs sovetskie simboly v bor'be za konstruirovanie landshafta', unpublished paper presented to International Conference 'Resistance, Protest and Criticism in the Name of Nature: USSR and Post-Soviet States, 1950–2010', Moscow, 8–9 Oct. 2015. I am grateful to Dr Olenenko for sharing her unpublished paper.

[26] 'Poema o more' (Mosfil'm: USSR,1958). https://www.youtube.com/watch?v=CJN0riQ35kI (accessed 29 Apr. 2016).

[27] Philip P. Micklin, 'Irrigation Development in the USSR during the 10th Five-Year Plan (1976–1980), *Soviet Geography* **19**/1 (1978): 9–10.

region increased from under 100,000 hectares in the 1950s to over 500,000 hectares by the 1980s. It has fallen slightly, to around 420,000 hectares, since the collapse of the Soviet Union. The supply of water from the reservoir is essential to the part of Kherson region south of the Dnipro, which has less rainfall than other parts of Southern Ukraine. Irrigation has enlarged the area of land that can be used to grow crops and led to an increase in the population. Scientists point to the adverse effects of irrigation, however, such as salinisation of the soil, and emphasise the need for water conservation and ecologically-based management of use of this scarce and valuable resource.[28]

A far larger area of land is irrigated in southern Kherson region than in the adjoining regions of Mykolaiv and Odesa I had travelled through the previous day. This was evident to me from the appearance of the countryside. In addition to the broad canals of the irrigation system, I regularly saw the large fields of commercial farms irrigated by centre-pivot sprayers that create the characteristic green circles I had spotted in the area on Google Earth before I embarked on my trip. From the closer vantage point of the bus windows, I also saw areas of land that were not irrigated. Here, the consequences of the area's lower rainfall and less fertile soil were all too apparent. The vegetation was sparser and a duller shade of green. We passed through villages which lacked outwards signs of prosperity with the smallholders' scrawny cows and goats tethered nearby. One of the more depressing was called 'Nadezhda', which means 'Hope'. My impressions of the land without irrigation were similar to those of Professor Schmatz, a teacher of agriculture at Dorpat University in Livonia (now Tartu University in Estonia), who passed this way in 1837 on his way from Kherson to the estate of Askania Nova *en route* to the Crimea. Indeed, he recommended building a canal from the Dnipro to provide water. 'The costs would be quickly covered', he asserted, 'by the huge income that would be received from the soil.'[29] The value of the water from the Kakhovka reservoir has become all too clear to farmers in the Crimean peninsula. They had received it via the Northern Crimean Canal from its opening in 1975 until it was cut off by the Ukrainian authorities after the Russian annexation of the peninsula in March 2014. The events of March 2014 were still in the future, however, when, a little under three years

[28] I. Gukalova, D. Malychykova and I. Pylypenko, 'Irrigation of the Steppe Regions in Ukraine: Geographical Features of Nature-Society Co-Adaptation', unpublished paper presented to workshop 'Historical Ecology of Agriculture of the Southern Ukrainian Steppe', Stockholm University, 11–13 May 2015.

[29] Shmal'ts, 'Ocherki puteshestviia v Krym professora Smal'tsa, v 1837 godu', *Zhurnal Ministerstva Vnutrennikh Del* **36**/4 (April 1840): 422–7, 464.

earlier, I made my way to the nature reserve at Askania Nova, expecting to find myself stepping from a landscape transformed by human activity to one that had been protected.

NATURE PROTECTED?: ASKANIA NOVA BIOSPHERE RESERVE[30]

Back in the 1920s – I read later in the reserve library – travellers from Kakhovka could expect to find a cart drawn by a camel or horses to take them the last leg of their journey to Askania Nova. Nine decades later, rather more prosaically, I arrived by bus. The director, Viktor Semenovych Gavrylenko, spoke with justifiable pride and authority when, no doubt as he often did to guests from all over the world, he introduced me to the history of Askania Nova. It was founded in the late-nineteenth century and survived the horrors of the Civil and Second World Wars. It achievement of global importance was underscored by its recognition in 1985 as part of the UNESCO international network of Biosphere Reserves. The purpose of the network is to protect samples of the worlds' major ecosystem types for scientific research.[31] These samples of ecosystems serve also as standards against which the impact of human activity on the environment can be measured. Among the pioneers of this important principle for nature protection, back at the end of the nineteenth century, had been Russian scientists such as Vasilii Dokuchaev and the founder of the reserve at Askania Nova, the German landowner Friedrich Faltz-Fein.[32]

The fragile ecosystem of the steppe is destroyed, for ever, by ploughing. It had been Faltz-Fein's vision in the 1880s to protect a sample of unploughed steppe as ever more of this rich land was ploughed up and sown with wheat for export. His early attempts were not satisfactory as the vegetation on the plots he chose had been damaged by ox carts transporting the grain that crossed the land. But in 1898, with scientific advice, he designated an area that was more suitable. He ordered his estate workers to stop anyone who tried to cross the protected steppe and redirect them to the road. I learned

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[30] The reserve's official website is: http://askania-nova-zapovidnik.gov.ua/ (accessed 18 Jan. 2016).

[31] http://www.unesco.org/new/en/natural-sciences/environment/ecological-sciences/biosphere-reserves/europe-north-america/ukraine/askaniya-nova/ (accessed 18 Jan. 2016)

[32] Douglas R. Weiner, *Models of Nature: Ecology, Conservation and Cultural Revolution in Soviet Russia*, 2nd edn (Pittsburgh, PA: University of Pittsburgh Press, 2000), p. 16; Feliks Shtilmark, *The History of Russian Zapovedniks, 1895–1995*, trans G.H. Harper (Edinburgh: Russian Nature Press, 2003), pp. 10–28.

from one of the guides that this created an awkward incident one evening when estate workers stopped the owner's brother and redirected him to the road. Faltz-Fain's family saw Friedrich's passion as eccentric, and perhaps incongruous for a member of a family of landowners who had made their living from exploiting, rather than protecting, the land.

Faltz-Fein's decision to protect a parcel of unploughed steppe against human impact was more prescient than he could have imagined. Between 1914 and 1921, war, revolution, foreign invasion, and civil war ravaged Southern Ukraine. But, the importance of the protected steppe meant it survived even these events. Askania Nova was excluded from the land reform that followed the Bolshevik revolution, when noble estates were broken up and distributed to peasant farmers. In 1928, the scientist B.K. Fortunatov wrote that, before the land reform, there had been thousands of hectares of scattered plots of unploughed steppe in Southern Ukraine. By the mid-1920s, however, of all the feather-grass steppe in the region, Askania Nova was the only remnant.[33] Much, but not all, of the protected steppe went on to survive Stalin's collectivisation of agriculture, the Second World War, invasion and occupation, and further campaigns to plough up virgin lands in the 1950s under Khrushchev. Thus, 520 hectares of the land Faltz-Fein set aside for protection in 1898 are still there.[34]

I explored the protected steppe in the company of a graduate student in botany. We discussed the history of the reserve as well the botany. We walked across the ploughed control area that surrounds the protected steppe and then through a buffer zone that is mowed once year, in June. But, Faltz-Fein's virgin steppe is absolutely protected from all human activities: mowing, grazing by domesticated livestock (the steppe had previously been used as pasture for sheep), fire and, above all, ploughing. The only human intervention is research by scientists monitoring the steppe ecosystem (and visitors authorized by the director). The concept of 'absolute protection' is the subject of debate among scientists and conservationists, who are considering the value of some intervention, such as carefully controlled and monitored mowing, grazing and burning, better to replicate the conditions in which the steppe evolved over millennia during

[33] B.K. Fortunatov, 'Stepnoi zapovednik', in M.N. Kolod'ko and B.K. Fortunatov (eds), *Stepnoi zapovednik Chapli-Askaniia Nova* (Moscow-Leningrad: Gosudarstvennoe izdatel'stvo, 1928), pp. 30–49.

[34] For an authoritative history, see Vladimir Evgen'evich Boreiko, *Askania-Nova: Tiazhkie versty istorii (1826–1993)* (Kyiv: Kievskii ekologo-kul'turnyi tsentr, 1994).

which humans and their livestock had played a part.[35] Even a walk across flat steppe has to have an objective, and ours was two ancient stone statues of women that Faltz-Fein had removed from the tops of ancient burial mounds (*kurgany*) and transported to his estate. As we walked across the steppe, my guide explained the types of plants, mostly grasses including the iconic feathergrass (*kovyl'*) of which there are three types at Askania Nova, various flowers and occasional thistles that stand proud of the grasses. I recalled a description of the local flora written over a century and half earlier, before the wholesale ploughing up of the steppe: 'What can compare with this ocean of flowers' blowing around in the wind?'[36] The vegetation, as my guide explained, is an indicator of the type of soil, in this case, dark chestnut (*temno-kashtanovaia*) soil, which is characteristic of the southern steppes in contrast to the black earth (*chernozem*) further to the north. An important factor in the types of vegetation and soil is the precipitation, here averaging under 400 mm a year. But, every ten to fifteen years there is a serious drought, and slightly less frequently, years with abundant rainfall, both of which affect the variety of plants in different ways.

My guide explained that a descendant of the founder, who visited Askania-Nova after 1991, had commented that local people seemed to have little concern for the environment, as if they were just passing through and did not have roots. We speculated on possible reasons. During the decades of Soviet power, there were forced movements of population. My guide, a native of western Ukraine, told me that one side of her family had been banished to Siberia during the repressions. She had visited her grandmother near Omsk as a child. Forced movements of people, we agreed, would undeniably affect of their sense of attachment to place. After 1991, there was a drastic cut in funding for scientific research at the institutes attached to the reserve. The local economy, as elsewhere in the former Soviet Union, had collapsed, causing over half the population of the settlement at Askania Nova to leave. It would be understandable if self protection, rather than nature protection, was uppermost in people's minds during this difficult time.

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[35] See V.S. Tkachenko and V.S Gavrylenko, 'Kryza reguliuvannia ta efektyvnist' reguliatornykh zakhodiv u stepovikh zapovidnykakh Ukrainy', *Visty biosfernoho zapovidnyka 'Askaniia-Nova'* **9** (2007): 1–20.

[36] A. Skal'kovskii, *Opyt statisticheskogo opisaniia Novorossiiskogo kraia*, 2 vols (Odessa: Frantsov and Nitche, 1850–3), ii, p. 7.

We moved onto more tricky ground – were there reasons connected with the local environment why people would not feel at home? Do people feel alienated by waterless, treeless steppe? Is it not a natural habitat for people? Are the only people who enthuse about it groups of scientists, and occasional environmental historians, who work here and visit from all over the world? Paradoxically, the founder of the reserve, Friedrich Fal'ts-Fein, seems to have had a mixed attitude to the steppe. As well as protecting a plot of native grassland, he also rather fundamentally altered the local environment by planting an artificial woodland, the Dendrological Park (Dendropark). He thus created a forested oasis of cool shade from the hot sun on the exposed steppe, perhaps recalling the forested German lands of his forebears. The Dendropark was, in fact, laid out in manner of an irregular English park. At the centre is a pond with an artificial grotto, both shaded by trees. Faltz-Fein so liked his creation that he took his afternoon tea in his woodland, shaded from the heat, and entertained his guests with musical concerts. A few of the trees – elms, hornbeam and others – have survived from its earliest days and are over a hundred years old. The trees are situated near what looks like a romantic folly of ruins and a tall, round, tower covered with creepers. This is the secret of the forest on the arid steppe: artificial irrigation. The tower is a water tower on top of an artesian well from which water flows by gravity along channels through the park to provide water for trees which otherwise could not grow in such an environment. Faltz-Fein's irrigated Dendropark is dwarfed many, many times over by the considerable areas of land irrigated by the more extensive system from the Kakhovka reservoir. Indeed, an aerial view of the locality on Google Earth reveals Askania Nova as an island of aridity surrounded by the round, green fields created by centre-pivot irrigation.

Not content with protecting an area of steppe and creating a woodland park, Faltz-Fein's vision for Askania-Nova included a zoo. He collected animals from all over the world and displayed them in paddocks rather than cages. His particular interest was in ungulates, i.e. grazing animals that lived on grasslands. On the second day of my visit I joined a 'safari tour' on a horse-drawn cart across a larger area of unploughed steppe, the Chaplinskii pod, which has been fenced off into large fields that contain herds of the grazing animals I saw in the zoo. Thus, we drove past herds of zebra, various species of deer, goat and antelope, and quite a large herd of north American bison. Attempts to keep European bison (*zubr* in Russian and Ukrainian) on the steppe have not been successful as they are accustomed to the cooler atmosphere of forests and struggled

with the heat of the steppe. I asked how the animals from hotter climes survived the harsh, Ukrainian winter, and was shown pictures of some of them being fed hay when the grass was covered in snow.

The collection of grazing animals contains not just species introduced from other parts of the world, but examples of the indigenous fauna of the steppes. For me the highlight of the 'safari' was a steppe animal I had not seen before – the rare saigak or steppe antelope.[37] Askania Nova has the largest herd of this endangered animal in Europe. Around 300 of these curious, timid creatures live on the Chaplinskii pod. One of their more distinctive features is inflatable nostrils that have evolved to help them cope with the extremes of the steppe climate. They have also evolved the ability to run fast, with intermittent jumps, to escape from predators. Many of the saigaki had young with them, born less than a month earlier at the start of May, and were sufficiently alarmed by the arrival of a cart load of visitors armed with cameras to make their escape, running at a moderate pace away from us. Two stragglers ran, and jumped, at great speed to catch them up. We also saw a herd of around fifty or sixty Przewalski's horses, a little timid, some distance from us. Askania Nova's first Przewalski's horses, which had been 'discovered' for science in Central Asia in 1879,[38] had been brought by Faltz-Fein from Mongola at the other end of the Eurasian steppe in 1899. These Central Asian or Mongolian wild horses differ slightly in colour and some other ways from the local, but extinct, wild horse, the tarpan. Falz-Fein had been familiar with the tarpan, and noted with sadness that the last recorded examples had been killed by poachers not far from his estate in 1879 and 1882.[39] Although the inclusion of examples of native, steppe fauna in the collection of ungulates was consistent with the aim of protecting a sample of native, unploughed, steppe, Falz-Fein's larger collection of animals and birds, which he bred and interbred, and the creation of an artificial, irrigated woodland indicate that his vision for Askania Nova was broader than simply protection of the local steppe

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[37] D.P. Mallon, *Saiga tatarica*. The IUCN Red List of Threatened Species 2008: e.T19832A9021682. http://dx.doi.org/10.2305/IUCN.UK.2008.RLTS.T19832A9021682.en (accessed 18 Jan. 2016); V. Gavrilenko, 'Askania Nova, a semi-natural Saiga captive breeding centre', *Saiga News* **9** (2009): 14–15 http://china.wcs.org/Portals/136/Saiga%20News/Saiga%20News_Issue_9.pdf (accessed 12 May 2016).

[38] S.R.B. King et al., *Equus ferus ssp. przewalskii*. The IUCN Red List of Threatened Species 2015: e.T7961A45172099. http://dx.doi.org/10.2305/IUCN.UK.2015–2.RLTS.T7961A45172099.en (accessed 18 Jan. 2016).

[39] Fedor Keppen, 'K istorii tarpana v Rossii', *Zhurnal Ministerstva narodnogo prosveshcheniia* **303**/1 (1896): 125–31.

environment. After the Revolution and Civil War, the Soviet government recognised the scientific importance of Askania Nova and permitted its restoration and the replacement of the animals, most of which had perished. But, in the ensuing decades, the reserve's wider functions developed, as its scientific directors sought to balance nature protection with the demands of the Soviet centrally-planned economy. Thus, its objectives came to include the acclimatisation to the steppe environment of many species of plants and animals that could be of economic value. The reserve's research station was also charged with creating new economically-valuable plants and animals by hybridisation. For a while, from the late-1930s, it hosted a plant and animal breeding station that bore the name of Trofim Lysenko, the highly influential, if under-educated, Soviet scientist who believed that organisms could pass on acquired characteristics, such as resistance to cold and drought, to subsequent generations.[40] In recent decades, the reserve has moved back closer to its original purpose and is engaged in the protection of the natural steppe ecosystem and the collections of flora and fauna in the Dendopark and zoo; monitoring the environment of the reserve, scientific research, environmental education and tourism.[41] However, Askania Nova is not, and has never been, concerned solely with protection of a sample of the steppe environment amidst a much larger area transformed by agriculture.

Indeed, the origins of the reserve, and the money Faltz-Fein used to fund it, lay in exploiting rather than protecting the environment of the steppe. His family had made their fortune from extensive sheep farming. When his great grandfather bought the 50,000-hectare Askania Nova estate in 1856 it contained 50,000 head of sheep. These were in addition to the 100,000 head the family already owned. And these were only part of over 400,000 head of sheep that grazed on the arid steppe of Dneprovskii district (the region south of the Dnipro river and north the Crimean peninsula) in the 1850s. Sheep farming was a very profitable business at this time, bringing in an annual return of ten per cent on investments.[42] The land where some of these sheep had

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[40] Weiner, *Models of Nature*, pp. 70–8; Jenny Leigh Smith, *Works in Progress: Plans and Realities on Soviet Farms, 1930–1963* (New Haven, CT: Yale University Press, 2014), pp. 129–37, 143–4.

[41] See http://www.unesco.org/new/en/natural-sciences/environment/ecological-sciences/biosphere-reserves/europe-north-america/ukraine/askaniya-nova/; http://askania-nova-zapovidnik.gov.ua/guide.htm (accessed 18 Jan. 2016).

[42] Derzhavnyi arkhiv Odes'koi oblasti, fond 1, opis' 248, 1856, sprava 1580, ll.150ob.-151; Skal'kovskii, *Opyt*, ii, pp. 362–8.

grazed was my next destination, where I expected to be taking a step backwards into an environment that had been destroyed by human action.

NATURE DESTROYED?: THE OLESHKIVS'KI PISKY (SANDS)

Two and a half millennia ago, when Herodotus described the steppe region of Southern Ukraine, he focused on the largely treeless grassland. But, he noted an exception: an area of woodland on one side of the estuary of the river Borysthenes (Dnipro), which he called 'Hylaea'.[43] The morning after I returned to Kherson from Askania Nova, I joined an expedition led by Ivan Moysiyenko, a botanist from Kherson State University, to explore the location of Herodotus's woodland. (Our excursion was a rehearsal for a field trip that would be part of an international grassland conference to be held in Ukraine later that summer.)

After crossing the wooded floodplain on the far side of the Dnipro, we entered a curious landscape: ordered row upon row of artificially-planted pine trees (a mixture of Scots and Crimean pine). In the plantation beyond the Dnipro, the rows of pines are interspersed with plantings of black locust trees (*belaia akatsiia* in Russian), which had been introduced from North America, and other species of broad-leaved trees. In contrast to the Dendropark at Askania Nova, these trees grow without artificial irrigation as the sand underneath contains a reservoir of water. This was certainly not the woodland Herodotus had described, but mostly trees planted since the 1940s to bind the sand and prevent it from spreading. The forested area now covers around 80,000 hectares.[44] The Soviet government established forestry research stations and plantations in the area in the 1940s. They developed methods to plant trees, mainly pine but also broad-leaved trees, on the sands. In keeping with the contemporary 'Stalin Plan for the Transformation of Nature', they concluded that the best way to create a favourable water regime for trees was to destroy the natural vegetation by deep ploughing. Grassy plants, including African millet and rye, were planted to assist in

[43] Herodotus, *The Histories*, pp. 243, 246–7.

[44] E.G. Roman, 'Peski', Natsional'nyi Prirodnyi Park 'Oleshkovskie peski', http://oleshki.jimdo.com/ (accessed 20 Jan. 16).

binding the sands and protecting the saplings.[45] Attempts to bind the sands by planting shrubs and trees dated back to the 1830s and continued throughout the nineteenth and early-twentieth centuries. They had mixed success as the sands continued to drift, covering larger areas than could be planted.[46]

The sands themselves were a legacy of the river Dnipro changing its course to the northwest far back in time, leaving behind an area of sand, which became covered with woodland and grasses. But, exposing the sands, thus allowing them to drift and inundate more land, was a result of human activity in felling the trees and grazing livestock, especially sheep, on the grassy vegetation that covered the thin topsoil. The sheep not only ate the vegetation that bound the sand, but trampled on it, loosening it further, and leaving it liable to be blown around by the wind.[47] Much of the destruction of the fragile ecosystem of the area occurred after its annexation by the Russian Empire in 1783 and settlement by people from further north in the empire and from southeast and central Europe, who grazed cattle and sheep on the land. In 1841 the Russian naturalist Petr Koeppen noted how meadows and fields were being turned into infertile deserts and recommended banning the local population from grazing their livestock on the sands.[48] The migrants who grazed their sheep on the sands, as we have seen, included Faltz-Fein's forebears. In the 1930s, I learned during my visit, the Soviet government had raised vast herds of sheep in this location, without regard for the ecological consequences, to generate much needed foreign currency by exporting their high-grade wool. Over the period from the late-eighteenth to mid-twentieth centuries, the sheep grazed through the protective cover of vegetation, exposing the sands, which drifted, inundating villages, roads, farmland, and turning whole areas into a vast, sandy desert.

We had come to see the remaining sandy desert, now inside the protective ring of planted forest. What we saw was an even more curious landscape of sand dunes, known

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[45] P.A. Shripka and G.A. Berezovskii, 'Zakreplenie Aleshkovskikh peskov', *Les i step'* **10** (1950): 27–39. See also Denis J. B. Shaw, 'Mastering Nature through Science: Soviet Geographers and the Great Stalin Plan for the Transformation of Nature, 1948–53', *Slavonic and East European Review* **93**/1 (2015): 120–146.

[46] K. Fromm, 'Ob ukreplenii letuchikh peskov v Dneprovskom uezde Tavricheskoi gubernii', *Zhurnal Ministerstva Gosudarstvennykh Imushchestv* **75**/3 (1860): 1–18; A. Kostiaev, 'Ukreplenie letuchikh peskov', *Polnaia entsiklopediia russkogo sel'skogo khoziaistva*, 12 vols (St Petersburg: Devrien, 1900–1912), x, pp. 122–50.

[47] Roman, 'Peski'.

[48] [Petr Keppen], 'Ob Aleshkovskikh letuchikh peskakh', *Lesnoi zhurnal* **1**/3 (1841): 401–18; Fromm, 'Ob ukreplenii': 1–2.

as *kuchugury* or *bukhory* by the local population, covering around 160,000 hectares. Once the sand had been stabilised by grasses planted to bind them, the natural vegetation started to return. This was of great interest to the botanists as it comprised a rare habitat with uncommon species. Some of the vegetation we saw, such as Dnipro feathergrass and Dnipro birch, was specific to this area and found in only a few other places.[49] The birch is a pioneer species that moved in soon after the sand was stabilised. Among the sandy areas are also places where the water is nearer the surface and are marshy and covered with luxuriant, green vegetation. We spent some time exploring the area on foot, seeing lizards and other wildlife, but careful to look out for snakes underfoot.[50] Snakes were not the only potential hazard. Ivan led us out of the sand dunes, partly because the landscape was so similar it was easy to get disorientated and lost, but also because a large part of the sand that had not been forested had been a military training area during the Cold War. Strategic bombers of the Warsaw Pact air forces used the area for target practice. Unexploded bombs rendered part of the area too dangerous for us to explore, but also too dangerous for foresters to plant more trees.

Ivan and other scientists are opposed to the over-forestation of the area as it destroys the rare habitat. He explained that planting trees in the area is difficult and expensive. The hot, windy steppe climate meant that forest fires break out periodically, destroying the foresters' work. The most recent serious fire had been in the summer of 2007. The timber harvested in the forest, moreover, is of limited value. The extent of the tree planting was so great that by the 1980s, the artificial woodland was lowering the level of the water table causing the sands to dry out.[51] Ivan had been one of the instigators of a campaign to have the sand protected. This was partly achieved when President Iushchenko declared part of the area a 'national nature park' in 2010. There was some opposition from foresters, as part of the aim of the scientists was to protect the sands from further afforestation. A compromise was reached and 8,000 hectares have been designated for protected status.[52] The tasks of the 'national nature park' are to protect the examples of different ecosystems, including arid steppe and semi-desert, meadows

[49] http://redbook-ua.org/ru/item/stipa-borysthenica-klokov-ex-prokudin/; http://redbook-ua.org/item/betula-borysthenica-klokov/ (accessed 21 Jan. 2016)

[50] The flora and fauna of the sands are described in Roman, 'Peski'.

[51] Roman, 'Peski'.

[52] Ukaz Prezidenta Ukrainy Pro stvorennia national'noho pryrodnoho parku 'Oleshkivs'ki pisky', 23.02.2010 № 221/2010, http://zakon1.rada.gov.ua/laws/show/221/2010/ (accessed 21 Jan. 2016).

with more moisture, marshes and groves of broad-leaved trees, and also all flora and fauna and 'non-living' nature in the park. The park's scientific section monitors the environment and carries out botanical and zoological research, and there are plans to research the water regime. The park also promotes ecological education through organised tourism.[53] There is perhaps a paradox that part of an area where the natural environment has been destroyed but partly restored by human activity is now protected and considered of scientific importance. I noted also that locations I initially identified as contrasting examples of nature 'destroyed' and 'protected', the Oleshkivs'ki pisky and Askania Nova, turned out to have much in common with each other.

CONCLUSION

What did I learn from exploring Southern Ukraine that I could not have done from more conventional historical research in the books and archival documents that supplemented my work for this article? When I read about the local environment, I was not reading about some 'exotic', unfamiliar land I had no experience of, but one I had driven through, walked across it, been bitten by mosquitoes and looked out for snakes in, and had heard, smelt and felt. Moreover, exploring the steppe in the company of scientists who explained aspects of it to me made far more sense on site when we were discussing the environment that, literally, surrounded us. Over this and preceding visits to other part of the steppe, the environment had become sufficiently familiar that I could appreciate the nuances of change in the landscape described, and implied, by both writers in the past and the scientists I met. When I read old descriptions of the steppe, before it had been ploughed up and over-grazed, I recalled the virgin steppe I'd explored at Askania Nova (albeit without the zebra and north American bison, but with the saigaki and wild horses). When I read agricultural specialists from the mid-nineteenth century explaining that large-scale artificial irrigation was impossible on account of the topography and availability of water,[54] I recalled the massive engineering projects I had seen that had been constructed in the 1950s–70s to hold back the water of the Dnipro at

[53] E.G. Roman, 'Territoriia i istoriia sozdaniia', id., 'Zadachi i deiatel'nost'', Natsional'nyi Prirodnyi Park 'Oleshkovskie peski', http://oleshki.jimdo.com/ (accessed 20 Jan. 2016).

[54] E.g. M.N. Gersevanov, 'Ob obvodnenii iuzhnoi stepnoi polosy Rossii', *Zapiski imperatorskogo russkogo tekhnicheskogo obshchestva* **1**/1 (1891): 1–30.

Kakhovka and transport it south the arid steppes around Askania Nova and, until 2014, to the Crimean peninsula.[55]

How did my categories of nature 'transformed, preserved and destroyed' stand up to my experiences on my visit? It would be hard to deny that the steppe grassland of much of Southern Ukraine has been transformed by the expansion of arable farming, in particular commercial grain cultivation, over the preceding two centuries. Outside the protected plot at Askania Nova, little remains of the previous grassland. Ploughing destroys, and destroys forever, the complex grassland ecosystem that takes millennia to evolve. Thus, an environment 'destroyed' might better characterise the conversion of grassland to arable. It should be borne in mind, however, that the treeless grassland that was ploughed up was not a pristine 'natural' environment, but also a consequence of human intervention. The nomadic pastoral peoples who had formed much of the population for the preceding millennia, dating back further than Herodotus's account, had also fundamentally transformed the environment by grazing their vast herds of ungulates and using fire to promote the growth of fresh, young grasses for them to graze on. Both fire and grazing removed and prevented the regrowth of shrubs and trees which grow naturally in some parts of the steppe.[56] The steppe reminded me that there are few examples on our planet of wholly 'natural' environments, but most have evolved, step by step, over time as a result of both human and non-human factors.[57]

The area of protected grassland at Askania Nova may present the closest we have to what the steppe was like across much of Southern Ukraine before wholesale ploughing and cultivation. Faltz-Fein's decision to set aside an area of grassland at the end of the nineteenth century was just in time, as most of the rest was ploughed up over the

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[55] On 'place-based' environmental history, see Peter Coates, David Moon and Paul Warde (eds), *Local Places, Global Processes: Histories of Environmental Change in Britain and Beyond* (Oxford: Oxbow books/Windgather Press, 2016).

[56] See N.F. Komarov, 'Etapy i faktory evoliutsii rastitel'nostogo pokrova chernozemnykh stepei', *Zapiski vsesoiuznogo geograficheskogo obshchestva,* n.s. **13** (1951): 157–223; C.V. Kremenetski, 'Human Impact on the Holocene vegetation of the South Russian Plain', in John Chapman and Pavel Dolukhanov (eds), *Landscapes in Flux: Central and Eastern Europe in Antiquity* (Oxford: Oxbow books, 1997), pp. 275–87; I.I. Moysiyenko and B. Sudnik-Wójcikowska, 'The Flora of Kurgans in the Desert Steppe Zone of Southern Ukraine', *Chornomors'kyi botanichnyi zhurnal*, **2**/1 (2006): 5–35.

[57] On the role of indigenous peoples in transforming environments elsewhere, see Shepard Krech III, *The Ecological Indian: Myth and History* (New York: W.W. Norton, 1999).

following two or three decades.[58] But, protection is also human intervention and, as I learned from my discussions with the scientists, there are debates over different forms of 'management' of protected areas. Fire, for example, also occurs without human intervention and wild fauna, such as saigaki and horses, grazed on the steppe before humans intervened, set fires and moved their livestock onto the grassland. Askania Nova, I learned, had been a location not just for nature 'protection' but also 'transformation', or perhaps 'destruction' right from its establishment as a result of artificial irrigation, introducing non-native trees and wildlife, and also experiments in breeding plants and animals. All these continued, and became a larger part of the reserve's activities, in the Soviet period, especially the decades from the 1930s, when 'transformation' prevailed over 'protection' of nature.

Perhaps the most complex location to assess is the Oleshkivs'ki pisky, where I encountered environmental protection of scientifically-important ecosystems as well as the destruction and transformation of the environment I had expected to find. The inundation of the area by drifting sands, a consequence of the removal of woodland and overgrazing, seems to have been checked since the mid-twentieth century. But in part, this was achieved by introducing species of grassy plants and trees that are alien to Southern Ukraine. The belts of planted forest that surround and protect the remaining areas of sand are as artificial as the large fields of commercial crops I saw when I travelled across the region. The paradox of the role of the Faltz-Fein family in destroying the fragile ecosystem of the sands, by grazing their vast herds of sheep, as well as being in the forefront of environmental protection only a few tens of kilometres away at Askania Nova has already been noted. A further paradox of the sands is that use of part of the area as a bombing range during the Cold War, leaving a legacy of unexploded ordinance in the sands, which might be considered to be the ultimate act of environmental destruction, also served to protect the area. Sealing off the area for military testing, and closing off some of it to this day for safety reasons, left significant

[58] A.A. Chibilev, *Stepi Severnoi Evrazii: ekologo-geograficheskii ocherk i bibliografiya* (Ekaterinburg: UrO RAN, 1998).

areas of the sands untouched by almost all other forms of human impact, giving the 'natural' environment an opportunity to recover.[59]

What was the impact of Soviet central planning on the environment of Southern Ukraine? Most of the changes in the environment I saw were part of long-term processes of change that predate the start of Soviet central planning at the end of the 1920s. The transformation of steppe grassland to arable fields producing grain and other crops, the protection of samples of the environment for scientific purposes, and the destruction of ecosystems in the region by ploughing and overgrazing all began long before the 1920s. All the processes of change, however, were intensified under Soviet central planning. Some, such as irrigation from the 1950s, played a far larger role than they ever had before in this region. Environmental protection was not confined to the period before central planning, but continued throughout the Soviet period. Nor was environmental destruction specific to central planning, but also, or perhaps in particular, characterised the exploitation of the environment to grow crops and graze livestock in the nineteenth century. In the environmental history of Southern Ukraine, the key turning point was not the advent of central planning after the foundation of the Soviet Union, but the wholesale ploughing up of the steppe, converting pasture to arable, that followed the annexation of the region to the Russian Empire in the late-eighteenth century; and the replacement of the indigenous nomadic pastoralists by far larger numbers of settled arable farmers. The importance of agriculture in the region, before and after central planning, meant that the rural population exceeded the urban population of Southern Ukraine well into the second half of the twentieth century. Environmental change continues to the present day, in the uncertain post-Soviet period as Ukrainian agriculture adjusts to operating once again in conditions of global capitalism rather than centrally-planned autarky. Large-scale, mechanised state and collective farms have been replaced by commercial farms, on a similar scale but with more modern machinery and chemicals. But maximising output, now for profit rather than to fulfil planning targets, still means that conservation is of lesser importance in much of Southern Ukraine, outside rare places, such as Askania Nova and the Oleshkivs'ki pisky, which are subject to special protection.

[59] On the inadvertent protection of nature in militarised landscapes, and other 'troubled' areas, such as the Chernobyl exclusion zone in northern Ukraine, see Peter Coates, 'Borderland, No-Man's Land, Nature's Wonderland: Troubled Humanity and Untroubled Earth', *Environment and History* **20** (2014): 499–516.

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